The Injurious Insects and Plant Diseases

William Bradford Alwood

VIRGINIA STATE CROP PEST COMMISSION

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Circular in Relation to Some Injurious Insects and Plant Diseases

BY

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THE INJURIOUS INSECTS
AND
PLANT DISEASES

PROSCRIBED BY THE CROP PEST COMMISSION.

After the passage of the revised Crop Pest Law, approved May 9, 1903, the consulting entomologist was authorized to prepare an illustrated circular, explanatory of those insect pests and plant diseases officially proscribed by the commission. This work has been in hand, therefore, for some months, as the writer was only able to take it up at such times as his other duties would permit. The descriptive notes on the several insects and plant diseases dealt with by the Commission is made as brief as is consistent with the importance of the subject discussed.

It is thought desirable to use abundant illustrations so that every farmer may find some character easily observed by him, and for the further reason that many trained men, as physicians, teachers and others are now giving more attention to these subjects, and will, as a consequence, be interested in the microscopic characters of some of these troubles. Our only regret is that we have not been able to complete the microscopic studies of all the subjects treated in this paper.

INJURIOUS INSECTS.

The list of proscribed insects is limited to two species—viz., the San José Scale and the Woolly Aphis of the apple.

The San Jose Scale (*Aspidiotus perniciosus*).—Comstock.

The literature in regard to this insect pest is so voluminous that no general introductory statement is necessary; all who care to do so, may acquaint themselves with it. There is still, however, a general lack of appreciation of the fact that this insect attacks a large number of plants, and while it does not so seriously injure all of them, it may persist on a wide range of fruit and ornamental

plants, and thus be carried from place to place and readily escape to those plants which succumb more readily to its attack.

Known Host Plants of the San Jose Scale.

The list of plants on which this insect can live has constantly been extended as it becomes more widely disseminated, until now twenty-one families, comprising in all thirty-one genera and fifty-nine species of plants, are known to have harbored it. This shows an almost omniverous habit of feeding when taken simply as a general statement; but it is an important fact that only upon the species of the *Rosaceae*, and a few other incidental plants, does it thrive so as to do great harm. However, upon many of the others named, it lives and multiplies in such number as to render it necessary to take careful note of all these plants, if they occur in proximity to infested premises, or if orchards are to be planted in proximity to gardens, parks or other ornamental plantings. This pest is likely to occur where one would be least likely to suspect it, hence we publish the full list of host plants known to us. It has been compiled from our own records and from the literature on the subject. All those marked with an asterisk (*) have been found infested in this State. This list is of special importance to nurserymen and all persons who wish to make critical examinations for the San José Scale.

The list is as follows:

BERBERIDACEAE (Barberry family)—*Akebia quinata.*

TERNSTROEMIACEAE (Tea family)—*Actinidia polygama.**

TILIACEAE (Linden family)—*Tilia americana** (Linden or Basswood).

RUTACEAE (Rue family)—*Aegle sepiaria,** or *Citrus trifoliata* (Hardy orange).

CELASTRACEAE (Staff tree family)—*Euonymus sp.* (Spindle tree).

VITACEAE (Vine family)—*Vitis sp.* (cultivated grapes)*; *Ampelopsis quinquefolia** (Virginia creeper).

SAPINDACEAE (Soapberry family)—*Acer dasycarpum** (Silver Maple).

ANACARDIACEAE (Cashew family)—*Sumach sp**.

LEGUMINOSAE (Pulse family)—*Acacia sp.*

ROSACEAE—(Rose family)—*Prunus amygdalus** (Almond); *P. persica** (Peach); *P. armeniaca** (Apricot), *P. domestica,** *P.*

*triflora** *P. hortulana,** (Plums); *P. cerasus,** *P. avium,** *P. besseyi* (Cherries); *Spiraea sp., Fragaria chiloensis** (Strawberry; *Rubus strigosus** (Raspberry); *Rosa sp** (Rose); *Crataegus sp.** (Hawthorne); *Cotoneaster vulgaris, Photinia japonica* (Loquat); *Amalanchier canadensis** (Juneberry, or Service-berry); *Pyrus communis** *P. sinensis** (Pears); *P. malus** (Apple); *P. americana** (Mountain Ash; *P. cydonia** (Quince); *P. japonica** (Japan Quince).

SAXIFRAGACEAE (Saxifrage family)—*Ribes oxyacanthoides** (Gooseberry); *R. rubrum** (Currant); *R. nigrum* (Black Currant).

CORNACEAE (Dogwood family)—*Cornus florida var. rubra* (Red-bract Dogwood).

CAPRIFOLIACEAE (Honeysuckle family)—*Viburnum sp.*

EBENACEAE (Ebony family)—*Diospyros virginiana** (Persimmon).

OLEACEAE (Olive family)—*Syringa vulgaris** (Lilac); *Ligustrum vulgare** (Privet).

BIGNONIACEAE (Bignonia family)—*Catalpa bignonioides* (Catalpa).

URTICACEAE (Nettle family)—*Ulmus americana** (White Elm); *Maclura aurantiaca** (Osage orange); *Morus sp.** (Mulberry).

JUGLANDACEAE (Walnut family)—*Juglans nigra** (Black Walnut); *J. regia** (English Walnut); *J. sieboldiana* (Japan Walnut); *Carya olivaeformis* (Pecan).

CUPULIFERAE (Oak family)—*Betula sp.* (Birch); *Alnus sp.* (Alder); *Castanea americana** (Chestnut).

SALICACEAE (Willow family)—*Salix babylonica** (Weeping Willow) *S. laurifolia** (Laurel-leaved Willow, several horticultural forms;* *Populus balsamifera var. candicans** (Balm of Gilead);* *P. monilifera** (Carolina Poplar); *P. nigra var. italica* (Lombardy Poplar).

LILIACEAE (Lily family); *Wild Smilax,** *sp.*, not determined.

Notwithstanding the repeated statements to the contrary, we have never found this species on trees wild in the forest.

Appearance of the Scale.

The San José Scale is so minute that even the full-grown specimen is not readily discernible with the unaided eye until one has

had some practice in examining plants. A glass is necessary for any proper examination, and for this purpose we commonly recommend the ¾ inch hand lens, Catalogue No. 161, made by Bausch & Lomb, Rochester, N. Y. The proper season for thorough examination is when the plants are dormant, but one can examine them at any time.

An infested stem or twig, if moderately covered with the scales, will show under the glass mentioned about as in Fig. 1.

FIG. 1.—Twig with San José Scale magnified five times.

This figure represents a twig with the scales in position, magnified about five times. The artist made the drawing too smooth and picture-like, but it shows the external appearance of this scale. It may readily be separated from its near relative, the Ancylus scale, by reason of the circular, evenly,conical shape of the female scales, all showing a distinct central point.

In the summer the foliage on infested trees is sure to show the presence of the scale, hence the drawing at figure 2 is made to represent this condition. On the leaves one almost invariably finds

the male scales present in larger numbers than elsewhere, and these are here represented. The male scale is long, but at one end shows the round character of the female scale, and has a centrally located point. Several specimens of males show plainly in the drawing.

If fruit is present on infested trees, the scale insects are almost sure to find it promptly, and one can inspect bearing trees rapidly

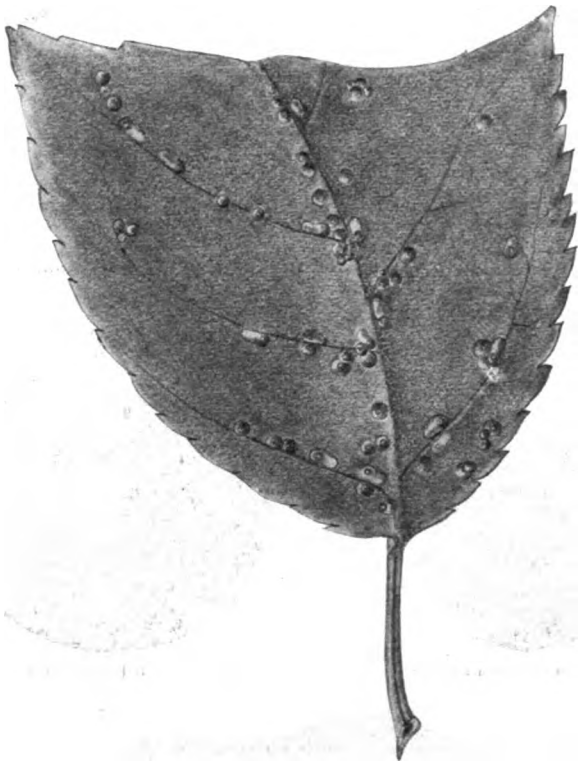


FIG. 2.—Leaf of Apple, showing San José Scale about natural size.

in mid-summer, by examining the fruit. The presence of the insect causes a slight depression, and a bright color forms around the scale, thus rendering it conspicuous. Often the fruit becomes so coated with the insects that it does not develop. The drawing, figure 3, shows a moderate infestation, but sufficient to destroy the commercial value of the specimens so infested. Infested fruit

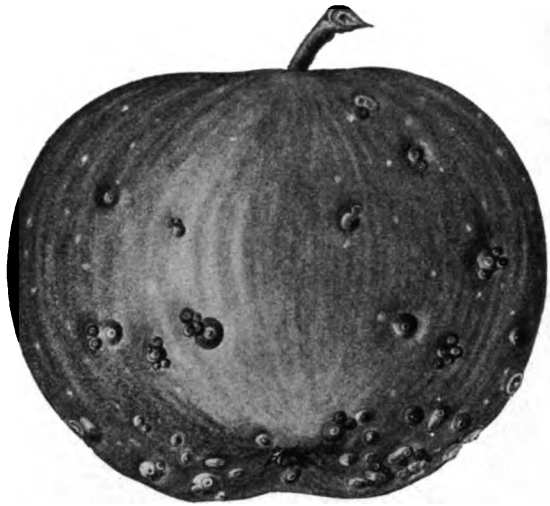


FIG. 3.—Apple infested with San José Scale, slightly magnified.

FIG. 4.—Half-grown Female.

FIG. 5.—Full-grown Female.

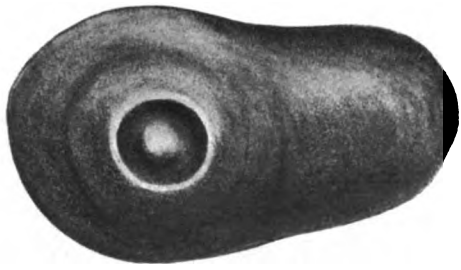


FIG. 6.—Full-grown Male—All much enlarged.

is not necessarily deleterious to health and may be safely used when pared, but it should never be packed for export, as we are likely to ruin our foreign markets if infested fruit is sent abroad. This would leave orchard growing utterly profitless, as the home demand cannot take the crop now produced.

Figures 4, 5 and 6 show much enlarged drawings of the scale coverings as they appear in perfect specimens, figure 4 being that of a half-grown female; figure 5, a full-grown female, and figure 6 a full-grown male, all enlarged 30 times. Here again the artist has made the drawings too much like a picture, but the representation is good.

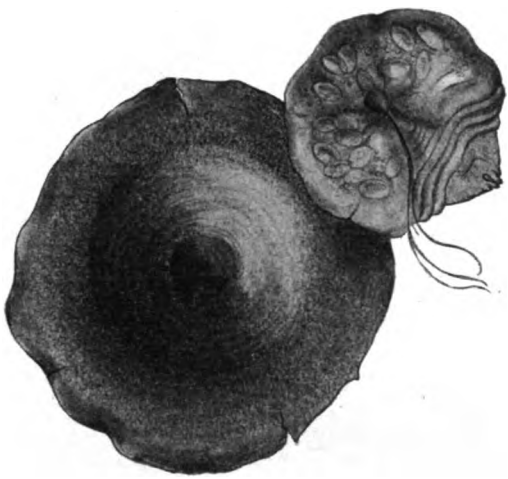


FIG. 7.—Old Female Exposed.

Figure 7 shows the scale of an old female turned over and the insect exposed. This drawing is enlarged about 40 times, yet this detail can be fairly well made out with a high-grade ½ inch hand lens, but not so clearly with the lens mentioned above.

The More Minute Structure of the Insect.

The further illustrations deal with characters which cannot be clearly seen with a hand lens, though figures 8, 9 and 10 do not require high powers. Figure 8 shows a drawing of the young insect just after birth. At this stage both sexes are alike—small, orange-colored, mite-like bodies, provided with feet, legs, antennae,

and the usual organs of insects; but on settling down, the young larvae insert their beaks into the soft tissues of the plants, and, in the case of females, do not again change their situation. After about 12 days the first skin is cast, and they lose their legs, antennae, etc., and remain a soft, almost formless mass under the scale covering, which has begun to take shape over them. The first appearance of

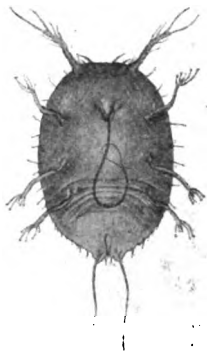


FIG. 8.—Young Scale Insect, enlarged 125 times

FIG. 9.—Mature Female Insect, much enlarged.

FIG. 10.—Winged Male, much enlarged.

the scale is a downy-like coating over the minute yellow or orange-colored larva, but it turns dark after the first moult and grows to the characteristic shapes shown in the drawings.

At the close of the larval period, the male acquires legs, wings and antennae, and has a brief existence as a winged insect, in which stage it impregnates the females. The males mature in about 26 days. The females mature in 28 to 30 days in the summer

season and at the end of this period begin to produce young. These are born alive, at the rate of 4 to 6 or more per day, varying with climatic conditions. Reproduction lasts from 4 to 6 weeks, hence the enormous multiplication of individuals is explained. During the dormant season practically all the insects die except the partially grown females.

Figure 9 shows the mature female insect much enlarged, with the partly-formed young, showing through the body walls. The bristles comprising the beak are all the organs apparent. Figure 10 shows the winged male also much enlarged. They may be observed on warm days hovering around the trunks and branches of badly-infested trees.

While the preceding characters enable one to determine the San José Scale under ordinary circumstances, none of them are suffi-

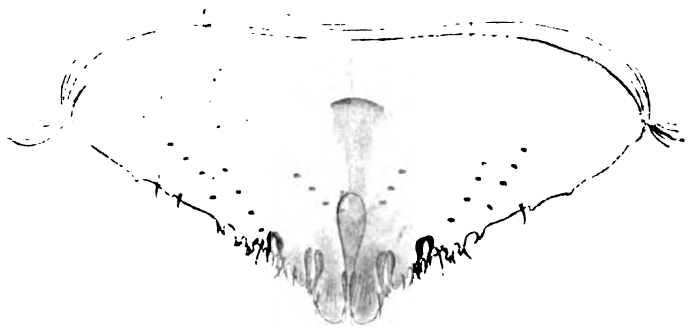


FIG. 11.—Last Segment of Female San José Scale.

cient for scientific accuracy. All the so-called scale insects show peculiar lobes, spines, notches, etc., on the last abdominal segment of the female; and, when properly mounted and viewed with a magnification of 250 to 500 diameters, these characters enable one to determine accurately the species of any scale insect. For the details of such determinations, see Newstead's Monograph, Green's Coccidae, or other texts.

Figure 11 shows a drawing of the pygidium, or last segment, of the abdomen of a female San José Scale. It is greatly magnified.

Nurserymen are required to destroy all stock infested with this insect and to fumigate all other stock with hydrocyanic acid gas. Methods of treatment are discussed in bulletins 131 and 141 of the

Virginia Agricultural Experiment Station. Copies of these publications will be furnished upon application to the State Entomologist, Blacksburg, Va.

The Woolly Aphis (*Schizoneura lanigera*)—Haussmann.

This insect has been a common pest on apple trees so long that it is generally known, yet its injuries are frequently confused with those of the fungus parasite, Crown Gall. It is a native species and

FIG. 12.—Stem Colonies of Woolly Aphis.

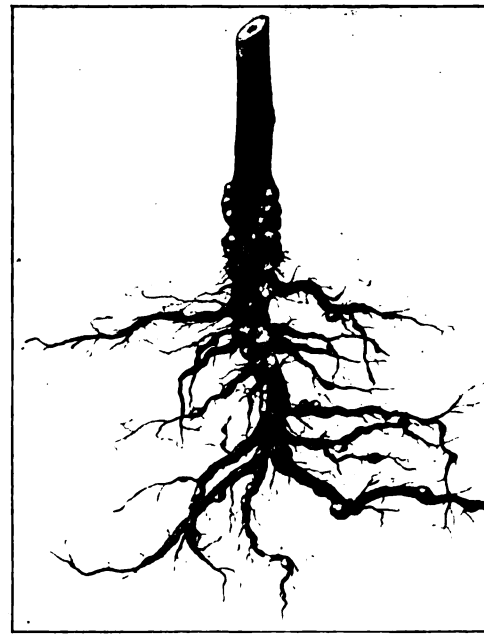


FIG. 13.—Crown and Root of Young Apple Tree, showing characertistic swellings or galls produced by the root lice.

has doubtless come to attack the cultivated apple from some of the near related forms of the genus Pyrus. In this country it causes but slight injury to the stems or branches, while in Europe it produces galls above ground, of the same nature that it produces on the roots in such abundance on nursery stock in this country. We commonly call it the Apple Root Louse, as it occurs only on apples, and usually damages only the roots with us. It is everywhere present and does some harm, doubtless to established or-

chards, yet it is our observation that if stock is planted with clean, healthy roots, this louse need not be feared. On nursery stock the Woolly Aphis is a most serious pest, and under some circumstances it ruins a large percentage of the apple trees in the nursery.

Appearance of the Insect.

This louse is called the Woolly Aphis because of the characteristic secretion of wool-like fibres of wax from its body. This wax

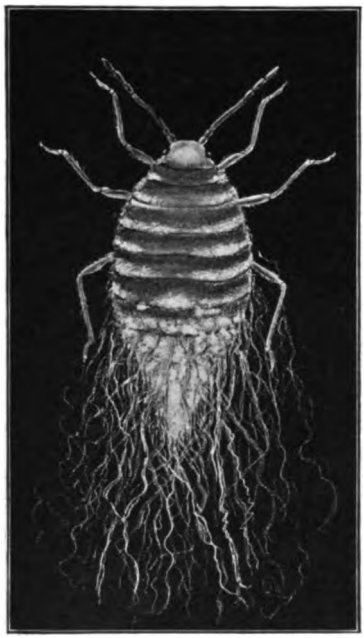


FIG. 14.—Agamic Female of Woolly Aphis, much enlarged.

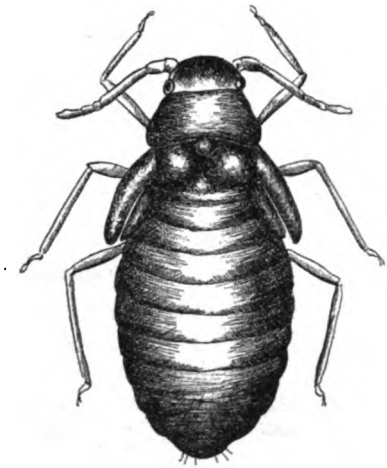


FIG. 15.—Pupa of Woolly Aphis, much enlarged.

has a bluish color and always marks the presence of the colonies of lice on the stems and branches; it is also present, but less marked upon the individuals occurring on the roots. Figure 12 shows a portion of stem of a young tree where a colony is partially secreted in the wound caused by cutting off a branch.

The lice invariably gather at such points and persist throughout the year in the wounds of this character, or those made from other causes. The colony represented on the side branch at the base of a

leaf is typical of the summer colonies. These rarely make large galls, but become at times very numerous in individuals and produce many winged migrants in the late season. The root is, however, the special seat of attack by this insect in our nurseries. On the roots wherever attacked characteristic galls or swellings are produced. These may be prominent about the crown of the plant, as well as on the tap root and side branches. This condition is shown in figure 13. A comparison with figures of crown gall will show clearly discernable differences between the two troubles.

The full-grown female louse and the pupal form are shown at figures 14 and 15 respectively. The long wax threads and downy

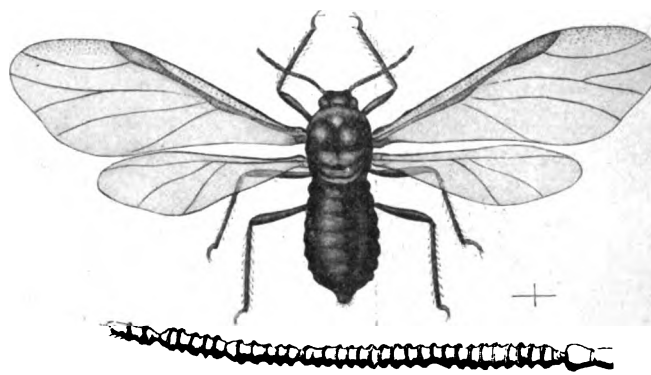


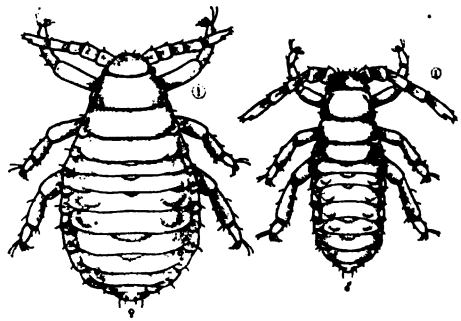
FIG. 16.—Winged Agamic Female of Woolly Aphis, much enlarged.

covering of the body are characteristic of the adult agamic female, but the pupa, figure 15, is quite clean of this covering.

This species, like the common plant lice, reproduces for the greater part of the year non-sexually, and the individuals are all females (agamic females). The young are produced alive at the rate of 2 to 20 per day. We have observed as many as 24 young from one female in 24 hours. An individual becomes grown in eight to 20 days, varying with conditions, and produces young for a period of two weeks or more before death. Thus the great numbers observed may be accounted for. The largest number of young taken from one individual was 123. While there is a true sexual generation, the agamic form persists throughout the year both in stem and root colonies in this latitude, and there appears to be no need of rejuvenation by means of sexual reproduction.

From the pupa shown at figure 15 there comes a winged migrant generation. This individual is shown at figure 16, and one antenna is shown much magnified below the adult. This is such an entirely different insect in appearance from the two above figures that one would not recognize the relationship without breeding them. It is also an agamic female, and produces young alive. Its function is in part that of a migrant which spreads the species, but primarily this form is the connecting link between the nonsexual and the sexual individuals. From these winged individuals are born true males and females usually four to six, composed of both sexes, in each case.

The mature male and female are shown greatly enlarged at figure 17. The small line gives the comparative size. These are



Female. *Male.*

FIG. 17.—Mature Sexual Individuals of Woolly Aphis, greatly enlarged.

very tiny individuals at birth and also very weak, so that rearing them is somewhat difficult. They have only rudimentary mouth parts, and take little or no food—in fact, I have reared them successfully in glass vessels with only strips of dry blotting paper for them to work upon. They become full grown in about eight days, and shortly after mating the female deposits the single egg indicated in the drawing figure 18, and dies. The immature egg can be readily seen as it forms in the body of the female, and this is shown at the left in figure 18. On the right is shown the egg extruded, and the body of the female in *situ* at completion of oviposition.

We have not thus far been able to trace the migrant forms accurately, and watch the development of their young in normal

situations. They behave in a very aberrant manner, and we are led to doubt the statements that their young are deposited in old colonies among the agamic forms. Definite search has not revealed them, nor have we been able to find the sexual egg in these old colonies. It is possible that there is here an unsettled problem which may have important practical bearing upon the distribution of the species.

Reasoning from species of like life history, we surmise that from the egg wherever laid, there comes in spring an agamic stem

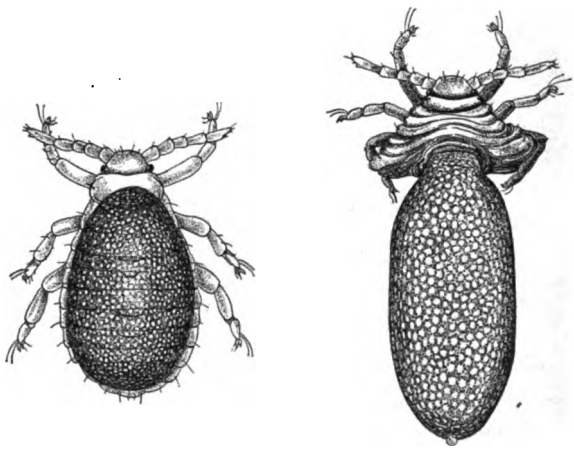


FIG. 18.—Mature Sexual Female, showing Egg before and after extrusion—greatly enlarged.

mother which starts a new line of sexless generations. While we have grown many sexual individuals and secured many eggs, we have not been able to keep and hatch them under such conditions that the young hatched from eggs came to maturity.

Persons planting trees should reject all trees which show the characteristic knots and swellings caused by the wooly aphis. Nurserymen should reject all such trees and fumigate all others grown in infested blocks. For further discussion of this subject see bulletin 102 of Virginia Experiment Station, and the third report of the State Entomologist.

PARASITIC DISEASES.

The Crop Pest Commission specified four plant diseases or troubles due to parasitic vegetable organism which should be inhibited in the nursery commerce of the State, and, so far as practical, dealt with in private premises. These are Crown Gall, Peach Yellows, Black Knot and Fire Blight. Some of these troubles are already well known to growers

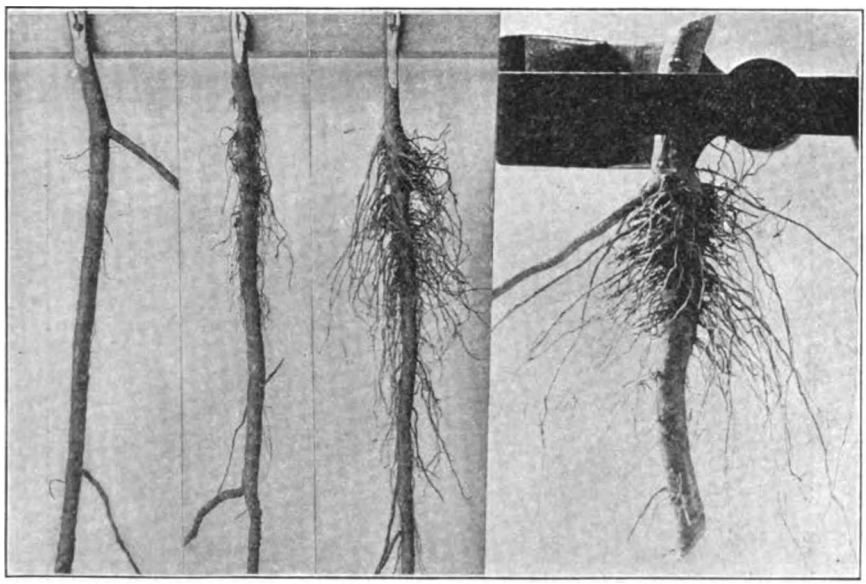


FIG. 19.—Healthy and Diseased Roots of Apple Seedlings. (Photo)

The Crown Gall of Apple.

This now very prevalent trouble in eastern nurseries has sprung into notoriety during recent years. Eight years ago it was scarcely noticeable on the nursery stock grown in Virginia, and it was not placed upon the list of proscribed maladies until July, 1901. At that time it had become so prevalent and its communicable character so apparent that it was thought proper to prevent, so far as possible, the sale of diseased stock. This conclusion was not readily acquiesced in by all parties, but the demonstration of the source and communicability of this trouble given later by the

writer, in Bulletin 140 Virginia Agricultural Experiment Station, has largely silenced opposition.

So far as published we believe no one has yet settled the specific identity of the organism which causes the crown gall of the apple, but Toumey in his work on a very similar disease of the almond

FIG. 20.—One-year Graft on Diseased Apple Root. (Photo)

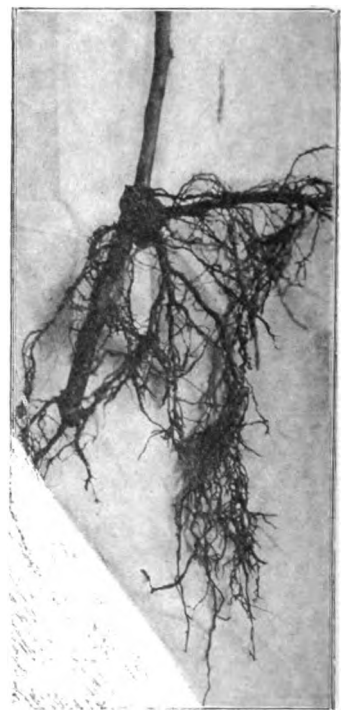


FIG. 21.—One-year Graft on Healthy Apple Root, inoculated with Crown Gall. (Photo)

has used the name *Dendrophagus globosus* for the parasite, and undoubtedly the form on apple will prove to be nearly related, if not the identical, species. This organism belongs to the slime moulds, as does the one which causes club root of cabbage.

The source of infection on apple in the State nurseries seems

clearly to have been the seedlings from various western nurseries. We at first noticed among apparently sound normal roots—some which were more or less "hairy"—i. e., covered with small fibers at and below the crown. These seemed so suspicious that in 1902 we undertook a series of experiments in grafting onto these "hairy"

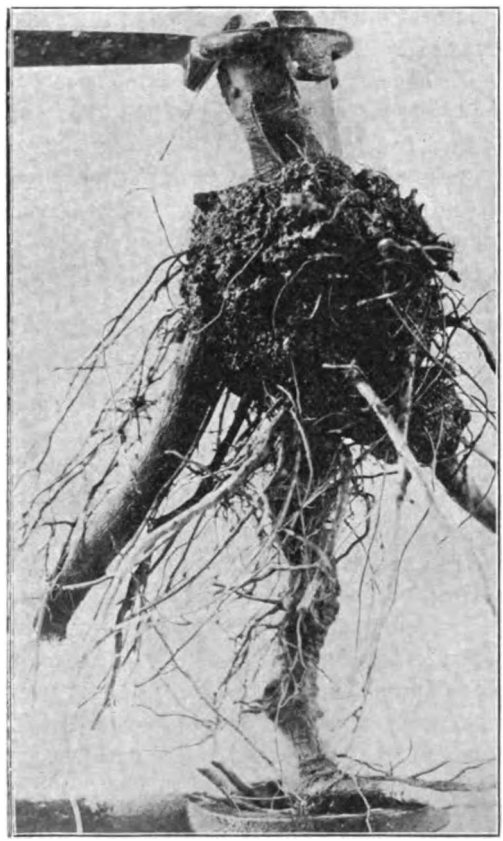


FIG. 22.—Crown Gall of Apple on Nursery Stock. (Photo)

roots in comparison with "clean" roots. The result of this experiment seemed to prove very conclusively that the hairy roots were the source of the disease. See Bull. 140, above referred to, for the details of this work.

The appearance of the healthy and diseased seedling roots is shown in figure 19. Beginning on the left, there is shown a nor-

mal healthy root and various stages of the development of the "hairy" root on apple seedlings is shown from left to right on the other three plants. All are one-year grown. These "hairy" roots were used as stock in a series of experiments and invariably produced Crown Galls. Sample plants are shown from this experiment at figures 20 and 21.

This work was carried to the extent of using the galls from well-defined cases on nursery trees for inoculating healthy stock. Wherever these inoculations were made by inserting pieces of gall into healthy tissues a case of crown gall resulted. Figure 21 shows such a plant with a decidedly abnormal development. Inoculated plants quite usually showed this growth. Clean roots selected from the same sources as the hairy roots produced sound trees.

Figure 22 shows a decidedly large development of crown gall. This is on a tree as it came from the nursery. The fibrous roots have largely disappeared by reason of decay. Many cases are not so well marked, but the illustrations clearly distinguish this trouble from the swellings caused by root lice. The following paragraphs seem to fairly sum up the results of our investigation so far as completed:

The organism which produces the abnormal growth known as crown gall on the apple appears to gain entrance to the apple seedlings in the nursery.

The diseased seedlings can be detected by inspection. The unusual amount of fibrous roots at and below the crown being the characteristic depended upon for recognition of the trouble.

Nurserymen can select the seedlings used so as to largely control this trouble. No one should expect to entirely prevent its occurrence in the nursery now that it has become so widespread.

Persons planting fruit trees should reject with the greatest care all trees which show the cancerous growth about the crown or a sufficiently abnormal development of fibrous roots about the crown to warrant belief that the plants are diseased.

Apparently, crown gall can be readily inoculated from a diseased plant into healthy ones, hence diseased plants should not be allowed to remain among healthy ones in the orchard. Cultivating the orchard may possibly serve to spread the disease by carrying disease germs from one tree to another. It is very probable that infection occurs without assistance wherever parts of the diseased tissues remain in the ground occupied by apple trees.

Peach Yellows.

This, the most classical disease of American fruit trees goes back in the literature to colonial days. Yet, no one to this day has discovered the specific cause or a cure for peach yellows. That it is a communicable disease and spreads with certainty and con-

FIG. 23.—Peach "Yellows," showing characteristic Bushy Growths, occurring on limbs and trunks of diseased trees. (Photo)

siderable rapidity is well known. Scientific investigation has definitely settled the facts as to the ease with which it may be inoculated from plant to plant, and has also settled the fact that thus far all so called remedies have not sustained the claims made for them when reduced to the strict test conditions of tech-

nical work. Thus we appear to be confronted by an obscure and elusive disease for which there is no known remedy. The characteristics of this trouble may be noted both in twig growth and in the fruit. If the latter ripens too early and shows rays of bright color radiating from the pit outward to the skin of the fruit, this is good evidence of the yellows. The further evidence is the peculiar growth of the twig. In well-marked cases slender twigs spring from the trunk and large branches grow rapidly and usually send off secondary shoots as shown in figure 23. The leaves on these twigs are slender, often yellow, and in marked contrast to healthy foliage.

The trees frequently come from the nursery already inoculated with yellows, and I have had them to show very characteristic cases the first year.

There is no remedy but prompt and thorough destruction of every infected tree as soon as the first symptoms are discovered.

Black Knot.

The black knot of plum and cherry is caused by a well-known fungus, the botanical name of which is *Plowrightia morbosa*. Its occurrence is now, unfortunately, so common that extended description is not necessary. The illustration at figure 24 tells the story and enables the novice to identify this trouble readily. This trouble is confined to the sour cherries and the plums of the garden and orchard, occurring also freely upon native wild cherries and plums.

The disease is disseminated by spores which escape from mature knots. While there are two kinds of spores, one of which is disseminated in late winter or early spring, and the other later during the season, their action upon the host plant is the same and do not complicate the remedial measures. There is no complementary host plant in case of this disease, thus the infection is direct by aid of spores from the knot to the unattacked branches or tender trunks of the host plants. The attack may occur on young trunks, on the main limbs and on the branches and twigs. It is on these atter that the common occurrence of the trouble is usually noticed.

The infection takes place through the germination of spores which have been scattered by natural agencies and found lodgment in the crevices of the bark. These spores germinate and penetrate

by means of a delicate thread-like growth into the cambium layers of the tissue where an abundant growth occurs, extending often

FIG. 24.—Black Knot of Plum and Cherry. (Photo)

along several inches of the stem attacked. This fungus growth irritates the tissues and causes the swelling which splits the bark

longitudinally and exposes the inner layers of the bark. This abnormal growth is first olive green in color. It increases rapidly in size, involving the entire stem, and later becomes a sooty black color. The knots can be most readily seen when the plants are dormant and should be cut out with great care early in winter before the resting spore is dispersed. Another examination should be made in late May or June to discover and remove new knots. If this work is done regularly from the time the trees are first set it requires but little time to go over several hundred trees. If a few knots are neglected for a year or two the whole orchard becomes a mass of knots and the task of eradication difficult. The knots should always be carried from the orchard and burned at once. Trees covered with knots should be cut down and burned.

This disease is one of the easiest to control of any now attracting attention and yet it is absolutely ruining some of our sour-cherry orchards and many plum and damson trees. It may very readily spread from old trees to nursery stock.

Pear Blight.

Pear Blight, or often called fire blight of pear and apple, is one of the more obscure diseases of the orchard and nursery. Its nature and cause are well known, yet the growth and dissemination of such minute organisms presents phases of plant life not easily followed. The specific cause is a bacterium (*Micrococcus amylovorus*), which has been often grown in artificial cultures and inoculated into pear trees to prove the identity of the organism with the disease.

In the case of the organisms of this group each cell is an entire plant and these multiply so rapidly and are so small that an indefinite number may be present in a few drops of juice which exudes from a diseased spot. They are active at all times when new growth is occurring and remain dormant in the diseased tissues over winter. With the recurrence of growth, wherever the sap comes in contact with the diseased areas, along the borders of "blight spots" of the previous year, on trunks and limbs, there is liable to be a rejuvenescence of the bacteria and their reproduction in immense numbers. At such points the sap frequently exudes in early spring, carrying the cells of the blight bacteria in great numbers. If these cells are in any manner, (by

aid of insects or higher animals or by rain and wind), carried and brought in contact with the tender shoots, with receptive blooms, or with wounds where access may be gained to the sap of the host plant, a new case of blight is likely to occur. Consideration of this statement will account for this trouble sweeping over orhards, under favorable conditions, like a fire. The appearance of fire blight is so well known that description is not necessary.

The old treatment of this trouble is by the knife or saw. For many years we have relied upon cutting out the affected parts as soon as discovered. If this is rigorously done, and especially if the trees are carefully gone over after growth ceases in the fall and every bit of blight wood taken out, the disease is greatly checked for want of germs to disseminate it.

This work is exceedingly laborious, and I have had the blight steadily progress in spite of just such efforts. About four years ago it occurred to me to try stimulation with a view of rendering the tissues resistant. This was attempted in 1901 on a couple thousand trees, with good results, and was repeated and other trees included in 1902 and 1903. Thus far the effect has been remarkable. Trees which had been literally cut to pieces in removing blight wood were saved. Two trees in the experiment on which the blight had extended to the trunk, so as to leave scarcely any live tissue, have lived through the last two years against all expectations. All trees where blight had not extended to the trunk were saved. Since beginning this treatment, no cutting of blight wood has been allowed, except that here and there an entirely dead limb has been removed. The treatment has been by use of Acid Phosphate, 14 per cent. goods, two parts, Muriate of Potash, 50 per cent. goods, one part, mixed and applied freely over the soil about the trees. From 5 to 15 pounds have been used, according to size and condition of trees treated. We make the application before the buds push, and work it into the soil, but further than this, leave the pear trees wholly uncultivated. In each case the treatment was made two years and discontinued. It is yet too soon to say just what we are to expect from this treatment, but is seems to be very promising. For the details or pear blight see bulletin 135, of Virginia Agricultural Experiment Station. The drawings used in this circular were made by Mr. J. F. Strauss, under the writer's direction.